DEER CREEK BRIDGE
Mount Rainier National Park
Spanning Deer Creek on East Side Highway
Longmire vicinity
Pierce County
Washington

HAER No. WA-57

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
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HISTORIC AMERICAN ENGINEERING RECORD

DEER CREEK BRIDGE
Mount Rainier National Park
HAER No. WA-57

I. INTRODUCTION

Location:	Spanning Deer Creek on East Side Road (Washington Highway 123), 3½ miles SSE of Cayuse Pass, Mount Rainier National Park, Pierce County, Washington. Quad: Chinook Pass, Wash. UTM: 10/613075/51B7225
Date of Construction:	1938-1939
Structure type:	Stone-faced reinforced concrete filled spandrel arch bridge
FHwA Structure No.:	9450-022P
Designer and Engineer:	Western Regional Office, Public Roads Administration, Federal Works Agency, San Francisco, California
Architectural plans:	National Park Service, Branch of Plans and Design, San Francisco, California
Contractor:	Sam Orino Construction Company, Portland, Oregon
Owner:	Mount Rainier National Park, National Park Service
Use:	Park highway bridge
Significance:	The Deer Creek Bridge is one of the larger "rustic style" bridges in Mount Rainier National Park. The reinforced concrete semi-elliptical arch bridge is faced in native conglomerate, and the rough stone veneer helps the structure blend into its rugged setting.
Project Information:	Documentation of the Deer Creek Bridge is part of the Mount Rainier National Park Roads and Bridges Recording Project, conducted in summer 1992 by the Historic American Engineering Record. Richard H. Quin, Historian, 1992

II. HISTORY

This is one in a series of reports prepared for the Mount Rainier National Park Roads and Bridges Recording Project. HAER No. WA-35, MOUNT RAINIER NATIONAL PARK ROADS AND BRIDGES, contains an overview history of the park roads. In addition, HAER No. WA-124, EAST SIDE ROAD, contains more specific information on the road on which the bridge is located.

East Side Road

Constructed between 1931 and 1940, ths East Side Road provided the final link in a north-south route across the east side of the park. Surveys and construction of the road were administered by the Bureau of Public Roads (reorganized during the work as the Public Roads Administration, a division of the Federal Works Agency), although the National Park Service supervised all matters related to landscape engineering and retained final approval over all work.

The 13.8-mile road* leaves the Mather Memorial Parkway [HAER No. WA-35g] at Cayuse Pass. The road drops along a steady grade for its first 2½ miles, in places carried out from the cliffs on stone retaining walls and benches. The bottom of the first grade is reached at Dewey and Deer Creeks, each of which is crossed at a sharp curve. Between them is a 507' tunnel, the only one encountered on the road. From Deer Creek, the road continues generally south-southwest, paralleling but keeping to the east side of Chinook Creek and, later, the Ohanapecosh River. Panther Creek is crossed on a replacement steel girder and reinforced concrets bridge about 4 miles south of Deer Creek. Two miles further south, the Stevens Canyon Road [HAER No. WA-35e] leaves the road and continues east to Paradise and Longmire. The East Side Road continues south, crossing Laughingwater Creek on a continuous beam concrete girder bridge [HAER No. WA-55] before reaching the Ohanapecosh development. The road continues on another mile to the park boundary, and then another 3 miles to a junction with U.S. 12, the White Pass Highway. The East Side Road is now maintained by the State of Washington and is numbered as Washington Highway 123. The road is open seasonally from late spring until the advent of winter.

Deer Creek Bridge

Surveys for the East Side Road were conducted by a BPR crew under the direction of Senior Engineering Inspection Foreman E. D. Kinney in the summer of 1931.[1] As part of this work, the site for the Deer Creek was determined. Long after the surveys had been approved by the National Park Service, the BPR was instructed to prepare plans and specifications for the bridge.

Mount Rainier National Park Resident Landscape Architect J. Haslett Bell went over the proposed bridge site with Public Roads Administration Associate Highway Engineer George B. Forrest in September 1936. They approved the site, but indicated they had no idea where the stone for its construction would be obtained.[2]

Plans and specifications for the structure were prepared at the Bureau's Western Regional Office in San Francisco, California in the winter of 1936-37. Architectural plans, giving the gsneral appearance of the structure and design details, were prepared by the Park Service's Branch of Plans and Design (also based in San Francisco) in May 1937.[3] The new bridge would differ from the other stone-faced arch bridges in the park through use of conglomerate for the

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* The mileage refers to the section of road within the park boundaries.

masonry rather than the customary granite. Larger blocks of stone were specified, and the base of the abutments was stepped.

The grading contract for the central 4.03-mile section of the East Side Road was awarded to the Sam Orino Construction Company of Portland, Oregon in 1936. As part of this phase of the work, a temporary bridge was constructed over Deer Creek to allow equipment to pass over the grade.[4]

The Secretary of the Interior authorized $74,000 for construction and $7,180 for engineering fees for the permanent bridge on 9 September 1937. Bids for the project were opened at the Portland, Oregon district office of the Public Roads Administration (PRA)* on 20 October. Four bids were received. The lowest was Sam Orino's bid of $64,822.50, and he was recommended for the project. The contract was executed by Orino on 25 October, and signed by the Secretary of the Interior on 25 November.[5]

Work began on 9 May 1938. Most of the crew was quartered at a camp 2 miles above the bridge site which Orino had erected for his adjacent grading contract. The majority of the laborers were obtained locally from Packwood, Washington, and vicinity. George B. Forrest, Associate Highway Engineer for the PRA, was in general charge of the project and all ongoing work that season in Mount Rainier National Park. He was supervised by John Zoss, Assistant Engineer for Bridge Construction for the PRA, and his assistant, Senior Rodman W. B. LeSeur. The engineers were housed in a camp at the Courtright Creek Bridge site on the Randle-Yakima or White Pass Highway (then under construction), as the Park Service would not allow engineers' camps in the national park.[6]

Original plans called for maintaining traffic (limited to construction vehicles on the upper section of the road) over the temporary wooden trestle already erected. As the trestle was located within the southern half of the new bridge site, the contract called for the structure to be built in separate halves. The Orino company asked to construct a new trestle downstream of the existing temporary structure so as to allow the new bridge to be constructed in one continuous operation. After determination was made that such a change would not mark the landscape or require the cutting of trees, a change order was issued allowing Orino to construct the new trestle. This did not require any extra cost to the Government, but allowed Orino to construct the new bridge far more rapidly.[7]

In their specifications, the BPR engineers estimated the following materials would be required for the construction of the bridge:

Class "A" concrete	770 cu. yds.
Reinforcing steel	61,000 lbs.
Masonry	1130 cu. yds.
Masonry facing	200 cu. yds.
Arch ring stones	960 sq. ft.
Membrane waterproofing	900 sq. yds.
Structure excavation (removed)	1450 cu. yds.
Masonry curb	209 lin. ft.

* The Bureau of Public Roads was transferred to the Federal Works Agency and reorganized as the Public Roads Administration on 1 July 1939. It was reconstituted as the Bureau of Public Roads in 1949 and transferred again, first to the General Services Administration and then to the Department of Commerce. Its functions are now the responsibility of the Federal Highway Administration in the U.S. Department of Transportation.

Grouted rubble gutter . . . . . 6 sq. yds.[8]

As the above quantities were only estimates, some alterations were made due to field requirements. For instance, the masonry facing was increased from 200 cubic yards to 261 cubic yards due to a variation between the structural plans and the architectural plans.[9]

The early work, performed by a crew of 27 men, constituted erecting camp buildings, followed by the cutting of the arch ring stones or voussoirs. Excavation work for both abutments then began, and framing bents for the new temporary bridge were put in place. This early phase of operations required the contractor to remove about 4' of snow and ice at the bridge site.[10]

The contractor opened up a rock quarry on the White Pass Highway immediately outside the park. Samples from the site were tested at the Oregon State Highway Department laboratories for freezing, thawing and abrasion. The rock, a dense gray conglomerate, proved satisfactory, although the tough stone was difficult to work. Equipment at the quarry included a stiff-leg derrick and a 2-hammer Ingersoll-Rand compressor for drilling.[11] The arch ring stones were laid out full size on a wooden platform and templates were made for each stone. The massive stones, weighing up to 7,000 pounds each, were then shaped at the quarry before being transferred to the site. Stone was also quarried for the construction of the spandrel and wing walls and the guard rail.[12]

Meanwhile, work was continuing at the Deer Creek site. The new temporary bridge, a four-span wooden trestle with log stringers, was completed in four days. Bents from the old bridge were left in place and later incorporated into the falsework for the arch.[13]

Excavation operations utilized a 10-B Lorraine shovel equipped with a boom attachment, which hoisted the removed materials with a skip and placed them into dump trucks. Excavation for the abutments was completed by 23 May, at which time two shifts of masons began placing the masonry facing. The stones were handled by another stiff-leg derrick with an 80' boom operated by a gasoline hoist. As the derrick had to be set up for each abutment, some delay was occasioned.[14]

While the masons were at work on the stone facing for the abutments, other workers were erecting the timber falsework bents for the main arch. The falsework used eight spans and was very substantial, with no deflection later detected in the stringers under load. Bents in the creek bed were supported by concrete footings. Formwork for the arch barrel was made of 2" tongue-and-grooved timbers with the rough side facing the concrete to, in the engineer's terms, "give a more rustic effect." The falsework was completed on 25 June and the arch ring stones were then set, using two derricks, including the one from the quarry site.[15]

Aggregates for the concrete were furnished by a commercial plant on the Cowlitz River near Packwood. The aggregate and concrete test cylinders were inspected by the Washington State Department of Highways laboratory at Olympia.[16]

Reinforcing steel for the bridge consisted of deformed bars with an allowable tension of 16,000# per square inch. The main reinforcing in the arch barrel was supported on metal chairs or hooped stirrups. Vertical bars for the outside surfaces of the arch were 5/8" diameter bars set on 10" centers. Horizontal bars were 3/4" (upper section) and 1" diameter bars (lower) on variable centers. For the tie beams and 1" square bars were anchored to 1/2" diameter hoops on 2' centers.[17]

The following schedule was observed for the pouring of the concrete: First, the concrete for the abutments was placed. Next, the crown of the arch barrel was poured, followed by the haunches. Construction keys between the crown and haunches were poured next. In the next step, the concrete walls above the crown were poured, and last, the spandrel walls sections above the haunches. The arch ring stones were placed between the first and second pours. These stones were attached with steel cramps to help them bond with the concrete. All concrete used was Class "A"; maximum size of the aggregate was 1½".[18]

Following the concrete work, the masonry facing for the spandrel walls was completed. At the same time, the pylons were brought up and work started on the wing walls. The struts were then poured and the falsework was then stripped. All exposed concrete surfaces were then covered with a membrane waterproofing by a subcontractor, the General Roofing Company of Portland.[19] Once the masonry spandrel and wing walls were complete, the arch was filled over and the grade was brought up to the top of the spandrel walls. Construction traffic was permitted over the new bridge on 8 October and the temporary structure was removed.[20]

Work then began on the placing of the masonry guard wall or railing. As with the arch ring stones, patterns were made for each stone in the rail, which were then held in place by a wooden frame, providing for a complete set of patterns for the entire length of the rail. The stones were then cut to size using the complete patterns. The Lorraine shovel, now equipped with a 40' boom, was used to place the railing stones and the remainder of the stone facing for the wing walls. On 8 November 1938, operations were interrupted by snow and freezing weather and a winter shutdown was ordered. The bridge was at this point 98 percent complete. The remaining work, which consisted of placing curb stones, placing of a rubble gutter along the adjacent parking area parapet walls, and the final approach grading, was completed in the summer of 1939. A work order issued on 6 July directed the contractor to remove stains on the masonry caused by leaching over the winter months and to apply a stain of lamp black on the underside of the arch. All work and cleanup was complete on 17 August 1939. Construction costs totalled $62,350. Engineering fees totalled $7,930, bringing the total cost of the Deer Creek Bridge to $70,280. The contractor suffered a loss on the project due to too low a bid on three items of the contract and misjudgment of the amount of masonry facing required.[21] The East Side Road was completed in 1940.

A fatal accident occurred at the bridge in August 1954, when Ralph Fisher lost control of his car and crashed into the bridge rail. Fisher was taken to the hospital in Enumclaw where he later died as a result of his injuries. Two months later, a car driven by Imogene Jennings of Pasco, Washington, also failed to make the turn and hit the bridge rail. The car turned over two or three times, injuring two passengers.[22] According to the park's eastern district ranger, a number of other accidents have occurred at the site, mainly caused by too great an approach speed for the sharp curve.[23]

An inspection by the Washington State Department of Highways in July 1976 revealed a few leaching cracks on the underside of the bridge. However, the condition was not considered serious, and no recommendations were made for repairs. Overall condition of the structure was judged satisfactory.[24]

Description

Deer Creek Bridge is a reinforced concrete arch structure faced in a dense grey conglomerate. The bridge is 268' 3½" long and spans Deer Creek Canyon on a single semi-elliptical arch with a clear span of 78.24'. The structure is 38' 6¼" wide, carrying a 27' two-lane roadway and a variable-width sidewalk with a maximum width of 4' 4½". The stepped stone-faced concrete abutments

rest on solid stone foundations with an overburden of boulders and sand. Unlike most of the other stone-faced bridges in Mount Rainier National Park, the abutments for the Deer Creek Bridge are massive stepped pylons, shouldering out from the face line of the structure and beneath the arch on horizonal shelves and emphasizes the solidity of one of the largest bridges in the national park. This treatment is not featured on any other bridge at Mount Rainier. The bridge is located in an intermediate forest vegetation zone at an elevation of 3,502'.

The concrete arch involves a series of tie beams and struts to reinforce its heavy load. Expansion joints, approximately 1" in width, are located between the strut intersections. A concrete bracing system supports the curb stones; this is unique among the park bridges.

Alignment of the roadway at the bridge site is a 20° curve, but the bridge is constructed with the arch on a tangent, providing extra width for the curve and for a 3'6" sidewalk on the upper side. The structure is superelevated 0.1 per foot for the 27' roadway.

The bridge was designed for a dead load of 150 pounds per cubic foot for the concrete and masonry and 100 pounds for the earth fill, with 125 pounds per cubic foot for the top foot of fill. The live load was to meet the H15 standard, giving a uniform load of 53½ pounds per square foot with a concentrated load of 1,500 pounds per square foot of roadway.[25]

III. ENDNOTES

1. O. A. Tomlinson, Superintendent, Mount Rainier National Park, Superintendent's Monthly Report, June 1931, 8. Mount Rainier National Park (MORA) Archives, Box H2615, Superintendents' Monthly Reports 1928-1931 file.

2. J. Haslett Bell, Resident Landscape Architect, Mount Rainier National Park, Monthly Report, September 1936, 2. MORA Archives, File H2615, Employees' Monthly Reports 1936 file.

3. U.S. Department of the Interior, National Park Service, Branch of Plans and Design, "Architectural Plans, Deer Creek Bridge, Proj. 5-D, Mt. Rainier National Park," construction drawings PG 619 A-F, 6 sheets (San Francisco, CA: National Park Service, Branch of Plans and Design, 18 May 1937).

4. Bell, "Annual Narrative Report to Chief Architect Through the Superintendent on Major and Minor Roads, and Trails, and Projects Other Than ECW for Mount Rainier National Park, Period: May 10 to December 17, 1936," 22 January 1937, 2. Mount Rainier National Park Archives, File D22, Construction Program 1936.

5. John Zoss, Assistant Engineer for Bridge Construction, Federal Works Agency, Public Roads Administration, "Final Construction Report (1938-1939) on Mount Rainier National Park, East Side Project 5-D, Deer Creek Bridge and Approach Grading" (Portland, OR: Public Roads Administration, 15 May 1940), 2-3.

6. *Ibid.*, 3-4, 7.

7. *Ibid.*, 4.

8. See BPR construction drawing RG 619-B.

9. Zoss, 7.

10. *Ibid.*.

11. *Ibid.*, 4-5.

12. *Ibid.*, 5, 11.

13. *Ibid.*, 5.

14. *Ibid.*.

15. *Ibid.*, 5-6.

16. *Ibid.*, 6.

17. See BPR construction drawings RG 619 E and F for details of the reinforcing steel.

18. See the pouring diagram and "General Notes" on BPR construction drawing RG 619-B.

19. Zoss, 6.

20. *Ibid.*.

21. *Ibid.*, 2, 6-7.

22. Curtis K. Skinner, Acting Superintendent, Mount Rainier National Park, Superintendent's Monthly Report, August 1954, 7; Superintendent's Monthly Report, October 1954, 6. MORA Archives, Box H2621, Superintendents' Monthly Reports 1953-1955 file.

23. Interview with Randy Brooks, Eastern District Ranger, Mount Rainier National Park, August 1992.

24. State of Washington, Department of Highways, "Inspection Report, Deer Creek Bridge" (Olympia: Washington State Department of Highways, 21 July 1976). Engineering Division files, Mount Rainier National Park.

25. See "General Notes" on BPR construction drawing RG 619-B.

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Tomlinson, O. A., Superintendent, Mount Rainier National Park. Superintendent's Monthly Report, June 1931. MORA Archives, Box H2615, Superintendents' Monthly Reports 1928-1931 file.

U.S. Department of Agriculture, Bureau of Public Roads. "Plans for Proposed Project 5-D, Bridge & Appr. Grading, East Side Highway, Rt. No. 5--13.8 Miles, Mt. Rainier National Park Highway System, Washington." Construction drawings RG 619 A-I, 10 sheets. San Francisco, CA: Bureau of Public Roads, 1936-1937.

U.S. Department of the Interior, National Park Service, Branch of Plans and Design. "Architectural Plans, Deer Creek Bridge, Proj. 5-D, Mt. Rainier National Park." Construction drawings PG 619 A-F, 6 sheets. San Francisco, CA: National Park Service, Branch of Plans and Design, 18 May 1937.

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